UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
WATER
QUALITY

Nutrient Water Quality Standards

Utah Lake Steering Committee and Science Panel

May 31, 2018

Overview

1. Water Quality Standards overview (Chris Bittner, DWQ)

2. Methods for nutrient criteria (Jeff Ostermiller, DWQ)

3. EPA approval role and lessons learned (Tina Laidlaw, EPA)

Water Quality Standards Introduction

Chris Bittner, DWQ Standards Coordinator

Water Quality Standards Introduction Overview

1. Water Quality Standards

2. Flexibilities

3. Standards rulemaking process

USES

CRITERIA

ANTIDEGRADATION

Water Quality Standards

DESIGNATED USES:

management objectives for surface waters, desires or goals; e.g., protection of aquatic life and recreation in and on the water

CRITERIA:

numeric values and narrative statements that represent a level of water quality that supports the designated uses

ANTIDEGRADATION POLICY:

protect high quality waters

Uses

Beneficial Uses = Designated Uses = Designated Beneficial Uses

≠ Water Rights beneficial uses!

Federal laws and regulations

- Fishable/swimmable uses required
- Fishable/swimmable uses presumed to be attainable in all waters
- Use Attainability Analysis required to demonstrate the use is not attainable

Origin of Fishable/Swimmable Uses

Clean Water Act Sec. 101. Declaration of Goals and Policy.

(a)(2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983…

Use Attainability Analysis
40 CFR 131.10(g) factors

1. **Naturally occurring pollutant concentrations** prevent the attainment of the use; or

2. **Natural, ephemeral, intermittent or low flow conditions** or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

3. **Human caused conditions** or sources of pollution prevent the attainment of the use and **cannot be remedied** or would cause more environmental damage to correct than to leave in place; or

4. **Dams**, diversions or other types of **hydrologic modifications** preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

5. Physical conditions related to the **natural features** of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

6. Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread **economic and social impact**.

Use Attainability Analysis Key Points

1. Must be based on 40 CFR 131.10(g) factor

2. Cannot be used to remove an Existing Use.

Existing Uses: “those uses actually attained in a water body on or after November 28, 1975, whether or not they are included in the water quality standards”, must be protected.

3. Must select the Highest Attainable Use.

Highest Attainable Use: “the modified aquatic life, wildlife, or recreation use that is both closest to the uses specified in section 101(a)(2)…”

4. Often used to support a change in criteria.

Numeric and Narrative Criteria

Deseret News©

Numeric: magnitude, frequency and duration

-example: *E. coli*, 126 cfu, 30-day geometric mean, never to exceed

Narrative: General Statement of "free from" conditions such as scums, oil sheens, undesirable aquatic life, etc.

-examples:

Fish kills, Beach closures, HAB concentrations

Criteria

1. Protective of the use
2. Do not consider economics or feasibility or ability to measure (considered in implementation)
3. Most Utah criteria based on National Criteria (95% of the species 95% of the time)
4. No National Criteria available for nutrients

General Process for Standards Changes

Compile supporting material and analyses

Present to Water Quality Standards Workgroup

Request approval from Utah Water Quality Board to begin rulemaking

File changes with Division of Administrative Rules

- Public participation requirements

Recommendations to Water Quality Board for Adoption

Water Quality Board Adoption

Submit to USEPA for Approval

Standards Introduction Summary

1. Uses, criteria and antidegradation comprise water quality standards

2. Uses are the goals for the water
   a. Aquatic life and recreation (fishable/swimmable) uses required
   b. Aquatic life and recreation uses presumed to be attainable for all waters
   c. A Use Attainability Analysis is required to demonstrate a use is not attainable

3. Use Attainability Analysis
   a. Based on 40 CFR 131.10(g) factors
   b. Cannot be used to modify an Existing Use
   c. Must select the Highest Attainable Use

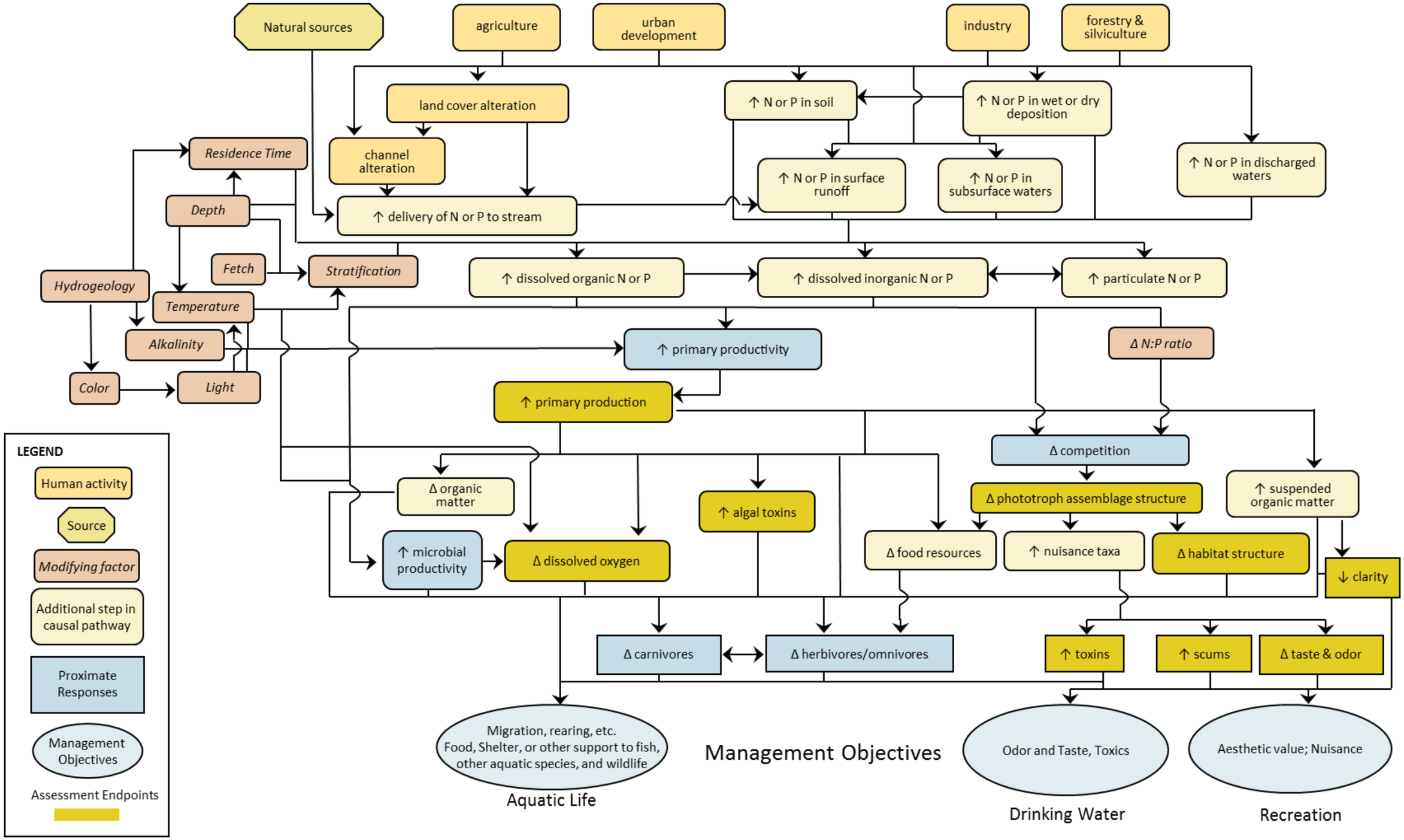
4. Numeric and narrative criteria
   a. Must be protective of use
   b. Does not consider economics or feasibility

utahlakecommission.org

Site-Specific Methods for Nutrient Criteria Development

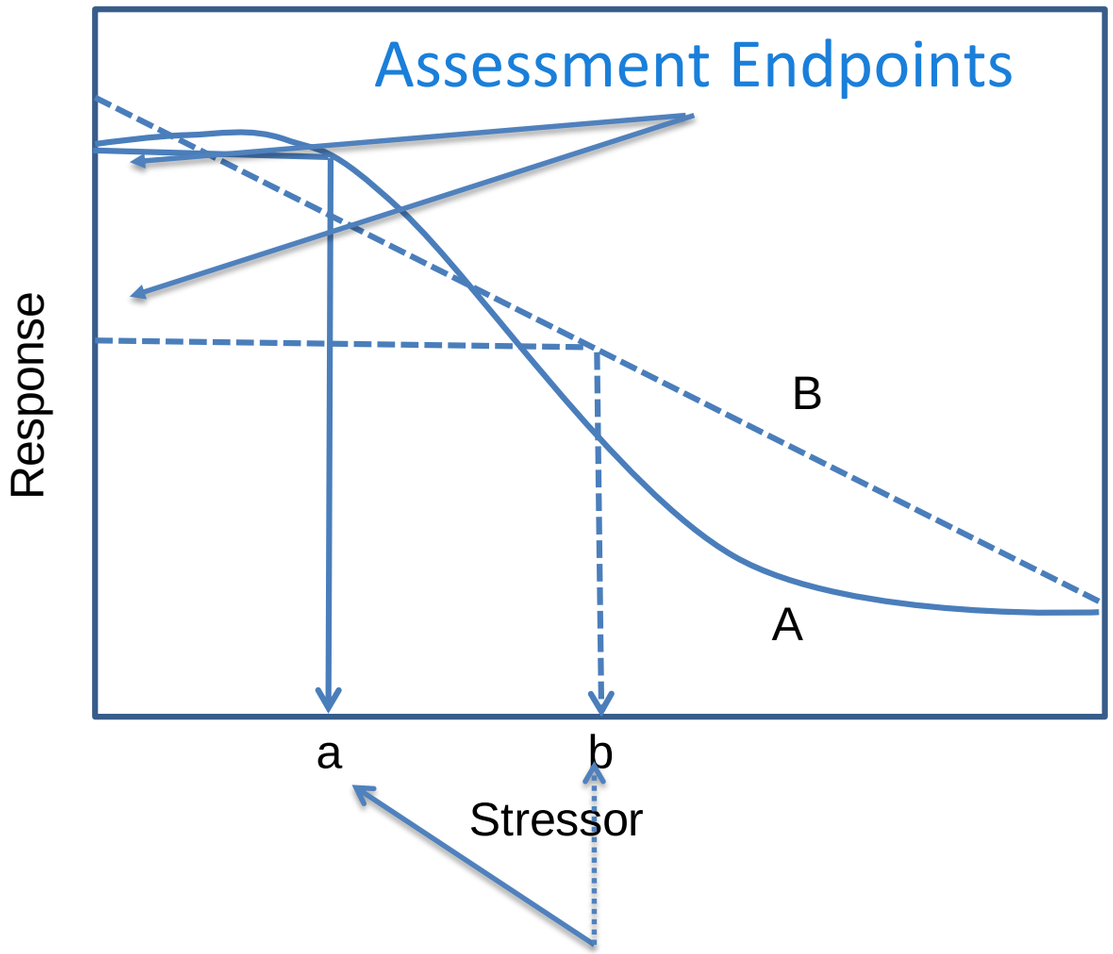
Jeff Ostermiller

Conceptual Models



Mike Paul, TetraTech

Stressor-Response Relationships



Phosphorous Thresholds (endpoints)

S-R relationships underpin all site-specific numeric criteria

- *Establish links to designated use support*

Many Different Approaches

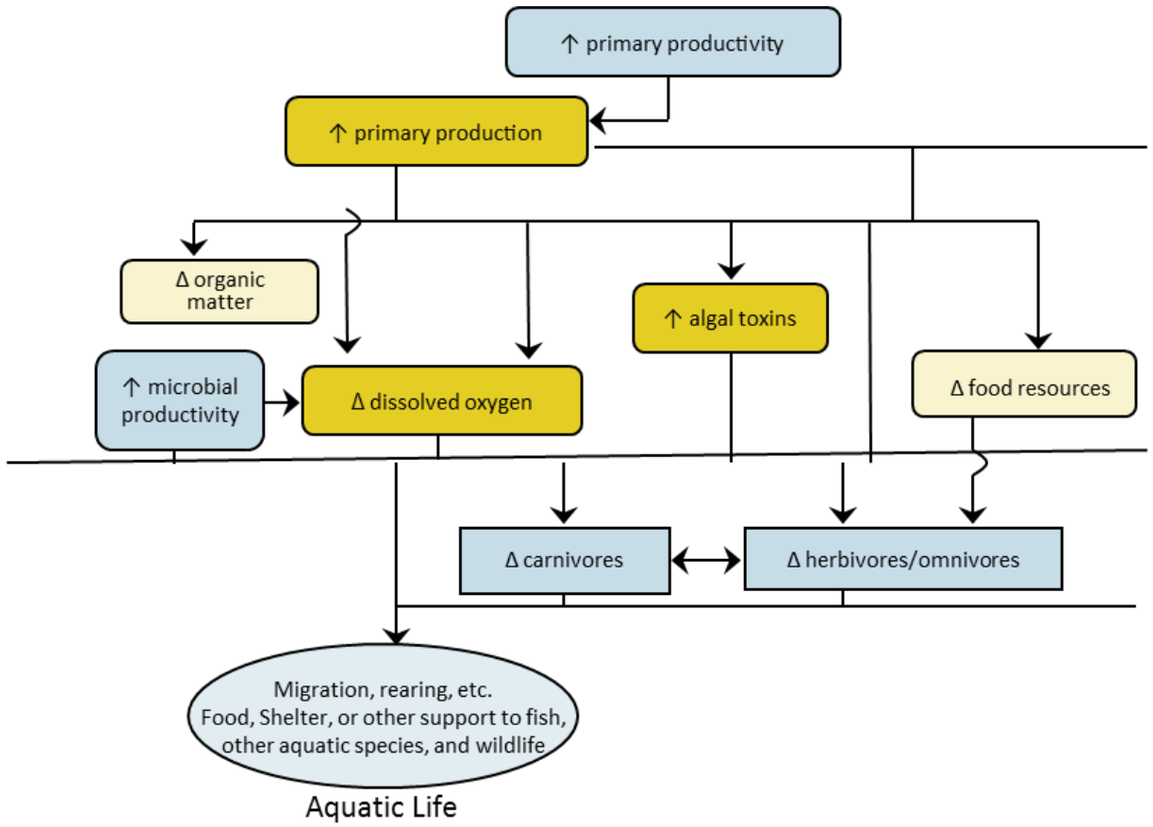
- *Empirical Models*
- *Process-based models*
- *Experimental*

Challenges

- *The world is a messy place!*
- *Covariance of stressors*
- *Modifying factors*
- *Spatial and temporal variation*

"In God we trust, all others must bring data." -W. Edwards Deming, Statistician

Identify Candidate Responses



Clarify management objectives

- *What is required to ensure the "maintenance and protection" of the use?*
- *Opportunity for collaborative management*

Identify water quality indicator(s)

- *Need to be reflective of management objects and responsive to enrichment*
- *Sometimes several are required to capture alternative causal pathways*
- *Relative sensitivity can be uses to prioritize among several within a causal path*

Identify Management Objective

- *Preexisting or TBD*
- *Determine how to best quantify water quality goals*

" If you don't know where you are going, you'll end up someplace else." -Yogi Berra

Define Response Endpoints

Aquatic Life Uses

Existing Numeric Criteria

- e.g., pH and DO
- Important parameters in most process-based models
- Not based on site-specific conditions

Water Quality Indicators

Not established criteria in Utah, but used for assessment purposes (e.g., Trophic State Index (TSI), biological assessment endpoints)

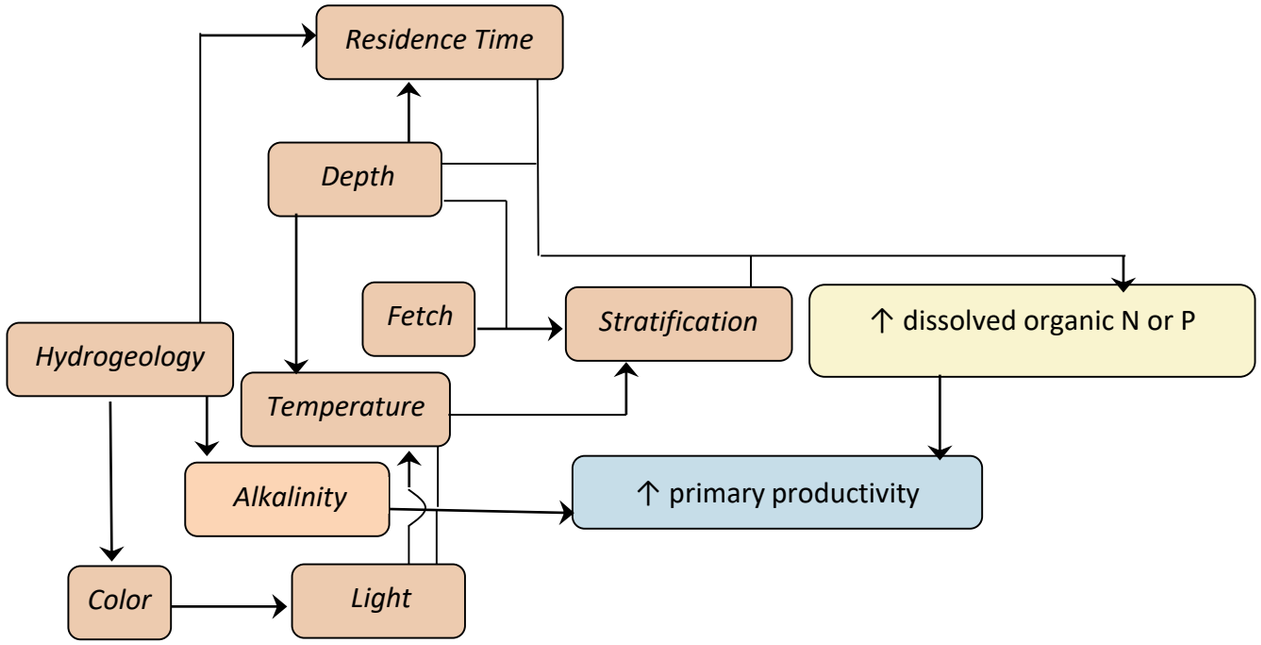
- Preexisting endpoints based on regional S-R relationships,
  - may require confirmation/modification to be specific to Utah Lake
  - setting endpoint would require assumption about “best attainable” or “desirable” trophic state

Recreational Uses

- Broadly applicable ties to human-health risks, site-specific considerations less relevant
- Accurate nutrient-cyanotoxin (S-R) relationship would be difficult to establish
- Is likely not the most sensitive (protective) use

“ If you don’t know where you are going, you’ll end up someplace else.” -Yogi Berra

Address Modifying and Confounding Factors



Important feedback loops, can affect:

- *Rates of primary production*
- *Distribution and abundance of lake biota*
- *Influence of other stressors*

Modifying Factors

- *Change the magnitude of the response*
- ***Useful in identifying index period where threat to uses are greatest***
- *Constraining S-R to periods with similar conditions improves relationships*

Confounding Factors

- *Affect <u>both</u>* stressor and response and confounds cause-effect inference
- *Decreases the accuracy of S-R relationships*
- *Can potentially be addressed analytically, if measure of each path are available*

Extrapolate Stressor (Nutrient) Endpoints

Process-Based (Mechanistic) Models

- *Mathematical models based on established relationships among processes in causal pathways*
- *Parameterized using data collected at the waterbody*
- *Require pre-determined response endpoints*

***Pros**:*

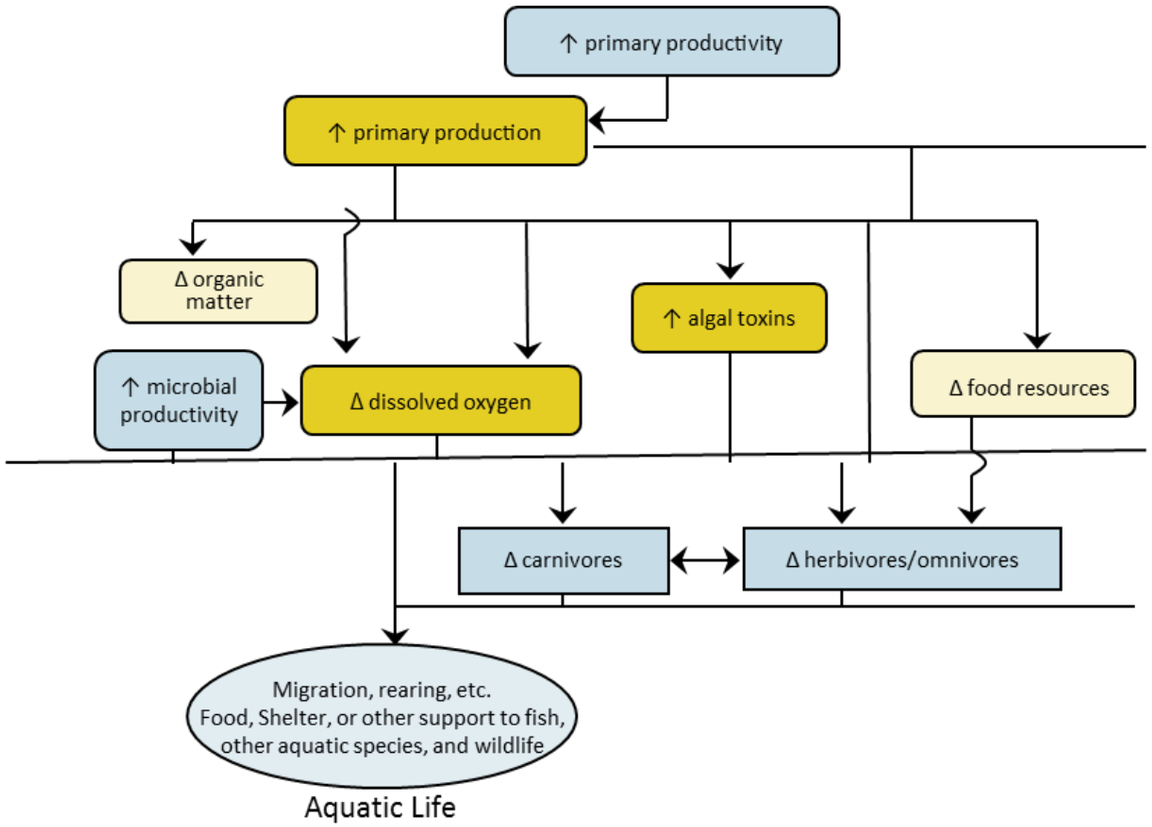
- *Can estimate unknown, future conditions*
- *Accounts for modifying and confounding factors*
- *generate stressor (nutrient) endpoints from known/accepted ecological linkages*

***Cons**:*

- *Models vary in complexity and accuracy,*
- *Some simplification of site-specific conditions required*
- *Indirect linkage to aquatic life use*

Getting Started

Exploration of existing data and information



Analytical Objectives

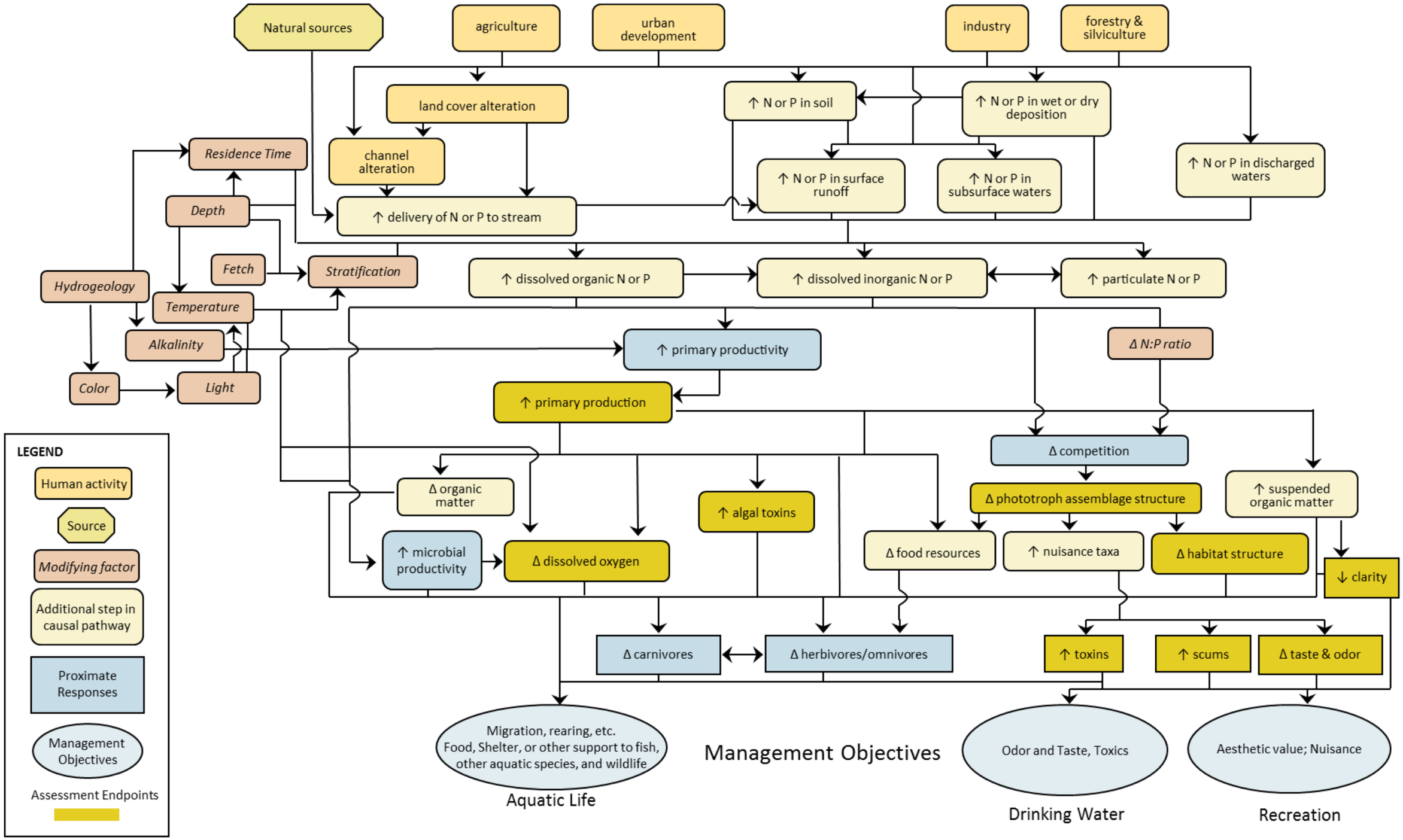
- *Quantify extent of the problem*
- *Identify data gaps*
- *Prioritize S-R causal pathways*
- *Identify or refine response endpoints*
- *Update conceptual model*

Data Summarization and Visualization

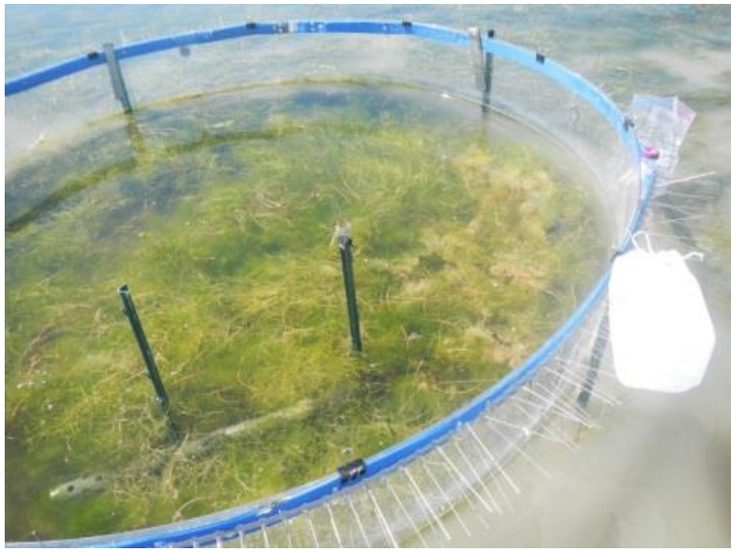
Develop Preliminary S-R Relationships

The first phase of the Utah Lake project.

Prioritize Data Gaps



Supporting Information: Experiments



The only way to Establish Cause-Effect Relationships

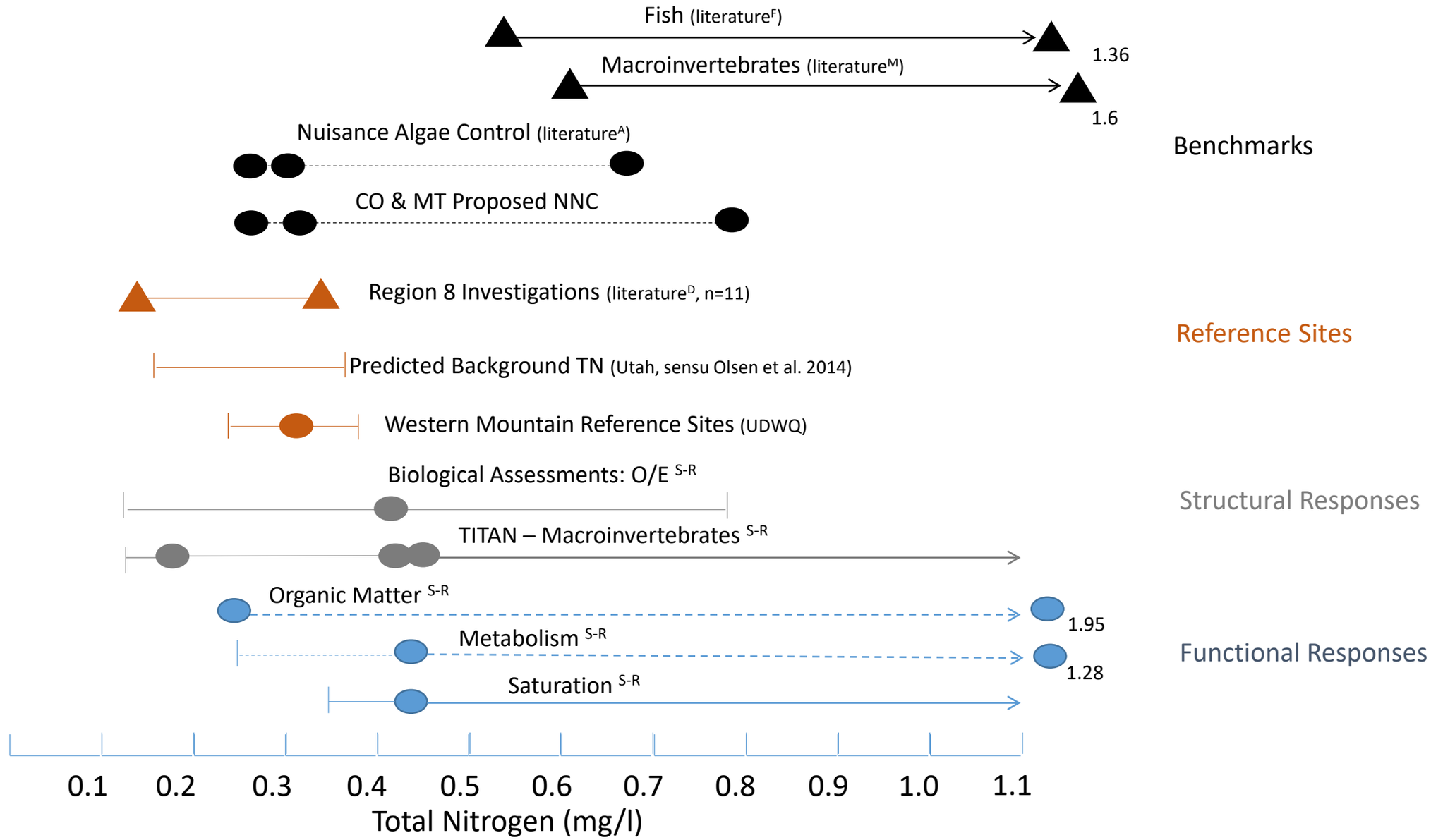
- *Address questions about the relative importance of nutrients vs. modifying and confounding factors*

Inform and Improve Accuracy of Water Quality Models

- *Evaluate mode accuracy*
  - *Are predicted S-R thresholds similar to those established from modelling efforts? If not, why not?*
- *Obtain or evaluate model parameterization data*
  - *Are the underlying model assumptions valid?*

Minimize Uncertainty

Multiple Lines of Evidence



Weight of Evidence

- Using multiple lines of analysis to define a specific endpoint
  - Requires best professional judgement
  - Often useful to consider how lines of evidence will be prioritized
- Alternative to single analysis approaches
- Especially useful where clear endpoints may be elusive

Thank You